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ABSTRACT

The purpose of this study was to determine whether reformed science and math courses at community colleges and universities were impacting education majors as they began a teaching career. The reformed courses, in contrast to typical lecture classes, implemented inquiry-based methods that emphasized deep understanding of fundamental science and math concepts. Trained evaluators, utilizing the Reformed Teaching Observation Protocol (RTOP) gathered a total of 86 classroom observations to gauge the level of reform that beginning teachers (1-3 years teaching experience) were implementing in grades 5-12. The preservice experience of the beginning teachers varied from having had zero to four reform courses. Results indicated that teachers who had completed reform college courses instructed in a significantly more reformed manner. Furthermore, analysis of years of teaching experience revealed that, while both control and experimental groups achieved higher RTOP scores as they progressed from year to year, the experimental group significantly outpaced their counterparts. Appended are Points of Interest on the Graph. (Contains 15 references and 6 tables.) (Author/SM)

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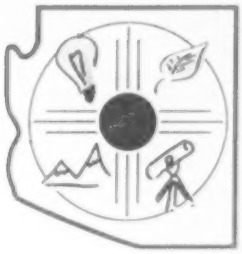

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Tracking Transfer of Reform Methodology from Science and Math College Courses to the Teaching Style of Beginning Teachers of Grades 5-12.

Eugene Judson and Daiyo Sawada, Arizona State University

The purpose of this study was to determine if reformed science and math courses at community colleges and the university were impacting education majors as they began a teaching career. The reformed courses, in contrast to typical lecture classes, implemented inquiry-based methods that emphasized deep understanding of fundamental science and math concepts. Trained evaluators, utilizing the Reformed Teaching Observation Protocol (RTOP) gathered a total of 86 classroom observations to gauge the level of reform that beginning teachers (one to three years teaching experience) were implementing in grades 5 to 12. The preservice experience of the beginning teachers varied from having had zero to four reform courses. Results indicated that teachers who had completed reform college courses instructed in a significantly more reformed manner. Furthermore, analysis of years of teaching experience revealed that, while both control and experimental groups achieved higher RTOP scores as they progressed from year to year, the experimental group significantly outpaced their counterparts.

Tracking Transfer of Reform Methodology from Science and Math College Courses to the Teaching Style of Beginning Teachers of Grades 5-12

> At present, both preservice and inservice teacher education can be characterized as incoherent and fragmented . . . . In neither are the practices organized to carry out the vision of standards-based learning for all.
>
> Susan Mundry, Barbara Spector, Katherine Stiles, & Susan Louck-Horsley, 1999

As highlighted in the quote from Mundry, Spector, Stiles & Louck-Horsely (1999) there is a severe lack of continuity and coherence in the preservice and inservice education of mathematics and science teachers. Attempting to conduct a controlled experiment to conclude whether the graduates of a particular institution teach in a manner more aligned with reformed pedagogy as compared to graduates of other institutions would only characterize the incoherence and discontinuity of the domains of preservice and inservice education. ACEPT believes it has made a small step toward bridging this gap by developing an ongoing formative evaluation that facilitates preservice education understanding the challenges faced by beginning teachers while making known to school districts the reforms being instituted at local colleges. In some cases, the two establishments have even partnered to form new preservice/inservice institutions specifically aimed toward aiding the development of preservice and induction teachers.

The guiding objective of ACEPT's proposal to the NSF was "to better prepare K-12 teachers in science and mathematics." Entering the fifth and final year of funding, the Evaluation Facilitation Group (EFG) began focusing on the evaluation of beginning teachers. Gathering quantitative data regarding teacher performance, as it relates to reformed teaching, became a priority. An end product of the ACEPT project is the classroom teacher who has enrolled in reformed science and math preservice courses. In order to evaluate the effectiveness of ACEPT, these ACEPT teachers and a control group of non-ACEPT teachers were identified and assessed. There was a need to test an assumption that is well expressed by the adage "teachers teach the way they were taught." ACEPT hypothesized that if inquiry learning and improved classroom culture are incorporated into science and math college courses, then preservice education students will be able to transfer this reformed pedagogic style to the K-12 setting. ACEPT tested this hypothesis.

Review of Literature

Current support for reform of science and mathematics curriculum and classroom practice has been advocated for several years (AAAS, 1993; NCTM, 1989; NCTM, 2000; NRC, 1996). Studies have examined how these reforms, endorsed by teacher colleges, manifest in practices and beliefs of beginning teachers. Such research provides insight into the epistemological and contextual barriers encountered in actual classrooms. The

National Center for Research on Teacher Learning (NCRTL) queried more than 700 teachers and teacher candidates before, during, and after their participation in formal teacher education programs (NCRTL, 1992). Known as the Teacher Education and Learning to Teach (TELT) study, the NCRTL researchers were primarily concerned with investigating what teachers learned about teaching and learning while participating in different educational programs. The findings of the TELT study discredited several common myths about teacher education. Among the TELT findings was the understanding that majoring in an academic subject does not provide the knowledge needed to teach the subject. Teachers who majored in the particular subject they were teaching often were no more able than non-majors to explain concepts effectively to students. Interestingly, the TELT researchers did find one university-based series of courses that seemed to make a difference; in this series, students were required to reason about the subject, to argue about alternative explanations for what they encountered, and to test their ideas and those of others. Another myth debunked was the notion that short-term inservice workshops are an effective device to improve teaching practice. It was suggested that teaching practices are only likely to undergo substantial changes "when teachers have extended, ongoing assistance that is grounded in classroom practice." This is supported by Robinson's assertion that beginning science teachers should be encouraged to reflect on and make explicit the concepts that are connected to the teaching and learning of science (1995).

There is also a general indication from the literature that actual teacher practices may not be akin to teacher beliefs about instruction. As stated by Boethel and Dimock (1999), "there is a real danger that teachers are making only superficial changes while believing that they are implementing constructivist teaching approaches." According to survey data, less than one-fourth of first-year math teachers reported having students use manipulative materials at least several times a week despite their belief that using manipulatives helps students to learn and understand mathematics (Laberge and Sons, 1999). Marlow and Stevens (1999) noticed that actual classroom observations of science teachers in elementary and high school classrooms did not reflect the reform assertions of the teachers. Marlow and Stevens point out that a focus on student directed and open ended inquiry was not as evident in the classrooms as teacher statements would have one believe. Costenson and Lawson (1986) outlined likely reasons as to why practice does not support reported beliefs. Costenson and Lawson reported such reasons as a lack of time, an innate belief that inquiry teaching is too slow of a method, and personal discomfort.

An examination of current literature related to the practices of beginning science and math teachers reveals great reliance on two data sources. While some studies depend upon self-reporting (interviews, questionnaires) for insight into teacher practice (Laberge and Sons, 1999; Moscovici, 1998; Nagy, Collins, Duschl, and Erduran, 1999), other studies incorporate field notes obtained from classroom observations (Chang, H., 1998; Klepper, N. H. & Barufaldi, J. P., 1998; Marlow, M. P. & Stevens, E., 1999; Robinson,

S., 1995; Yei, C., Wang, K. and Huang, S., 1998). In either case, pedagogical style is not quantified but rather characterized.

Method of Evaluation

Beginning teachers were evaluated using a three-step method:

1. Beginning teachers were identified
2. Evaluators observed the teachers and quantified the level of reformed practices
3. Data collected from classrooms were analyzed using statistical methods.

Identifying Teachers

Although ACEPT has impacted college courses of future K – 12 teachers, limited resources demanded a focused effort during the first year of evaluation. The decision was made to concentrate effort on middle school and high school teachers (i.e. grades 5-12). Several techniques were utilized to locate beginning teachers and gain access to their classrooms. In some cases first year teachers were approached directly at orientation meetings that were part of the district's regimen. In the one local district, ACEPT presented a proposal of evaluation to department heads who then relayed the information to beginning teachers. In the another local district, a strong partnership was created with the district's resource staff. This collaboration allowed appeal for consent of teachers to

be filtered through official district channels, thus leading to a high level of participation. The uniqueness of TEAMS program (see accompanying paper by Piburn & Baker in this paper set) resulted in a direct approach. Former TEAMS students were phoned and informed of ACEPT's intentions individually.

Because of the voluntary nature of the process there was a factor of self-selection on the part of teachers. Teachers would elect to be observed by an ACEPT evaluator. As part of the summer 1999 plan of evaluation, those teachers choosing to be part of the research would be provided a generalized assessment of their lesson along with appropriate commentary by the ACEPT evaluator.

Formalizing the Observation

The Reformed Teaching Observation Protocol (RTOP) had been used by ACEPT in the evaluation of university and community college faculty. However, this would be the inaugural use of the RTOP in actual K-12 classrooms. Evaluators were people identified as understanding reformed instruction, had a background in science and/or math education, and partook in approximately eight hours of RTOP training. By the end of the fall 1999, seven evaluators had contributed observational data.

During the evaluation period, many classroom teachers were visited more than once. In some cases two evaluators would visit a teacher to observe and rate the same

lesson. In such instances, although the two evaluators might afterward discuss thoughts on the lesson, actual RTOP scores were not shared until officially entered into the database. In all districts other than one, the teacher was aware of the exact observation time. Later analysis would reveal there to be no significant difference between announced and unannounced observations. With the exception of TEAMS, evaluators were blind as to what preservice institution the teacher had received credentials from.

Dealing with Data

As observations were completed, RTOP data was submitted to a central location and entered into a database. Before data entry was complete, waiver forms were checked to identify the teacher's preservice institution. If the teacher was a graduate of Arizona State University, then registrar records were cross referenced to determine how many ACEPT courses had been completed. The amount of courses completed was dubbed "level of ACEPT." In the case of TEAMS, the program of study was scrutinized to ascertain how many of the TEAMS courses could be considered reformed and differing markedly from the typical education track. A conservative judgment of three courses was made.

In the statistical analysis, RTOP scores were the dependent variable. These were analyzed in terms of several independent variables including content, grade level, and level of ACEPT. A strategy used in conducting these analyses was to stratify teachers

based on years of experience. For example, when comparing ACEPT prepared teachers with non-ACEPT prepared teachers, the sample was stratified into 1st year, 2nd year and 3rd year teachers. It should be noted that since few observations were conducted of third year teachers these data were aggregated with second year teacher data. Further sampling during the three year evaluation extension will overcome these sampling limitations. Comparison of means was utilized to compose visual representations of data (box plots, bar graphs) and t-tests were employed to determine significance. In anticipation of more complete, and perhaps more sophisticated analyses in the future, all beginning teacher data were entered into an SPSS computer file.

Evaluation Findings

Eighty-six observations were completed during the first four months of evaluation (fall term, 1999). During the next three years, the number of observations will be greatly increased. Of these 86 observations, 53 were of teachers who had taken at least one ACEPT course and 33 observations occurred in classrooms of non-ACEPT teachers. Comparison of the ACEPT and non-ACEPT teachers revealed a significant difference in the level of reformed instruction as based on average RTOP scores for the groups (Table 1).

Table 1. Comparison of ACEPT and non-ACEPT teachers

	ACEPT	***Non-ACEPT***
n	53	33
RTOP Mean	51.1	*42.6*
Std. Dev.	18.4	*12.4*
t	2.584	
p	*<.05*	

In close analysis, and partly because of small sample sizes, significant differences between ACEPT and non-ACEPT teachers did not consistently hold true when examining subgroups (e.g. first-year science teachers, 2nd and 3rd-year middle school teachers). Factors such as district environment and teacher's gender were weighed in the study to determine their effect within the subgroups. Only *years of teaching experience* was determined to be a key factor. To distill variations occurring when first through third year teachers are compared within subgroups; teachers were to be compared only with those of equivalent experience. As noted previously, due to small sample size, data of second and third year teachers were aggregated.

Level of ACEPT

To examine the hypothesis that more exposure to ACEPT courses leads to more reformed teaching, the data were divided into three *levels of ACEPT* exposure (no ACEPT, one ACEPT course, two or more ACEPT courses).

Figure 1

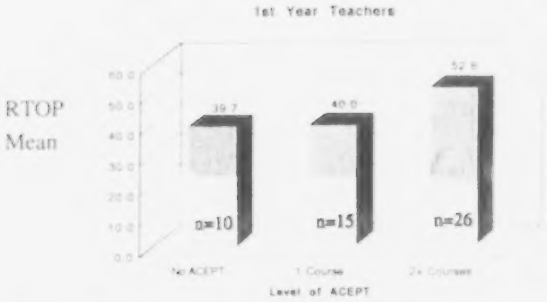

Figure 2

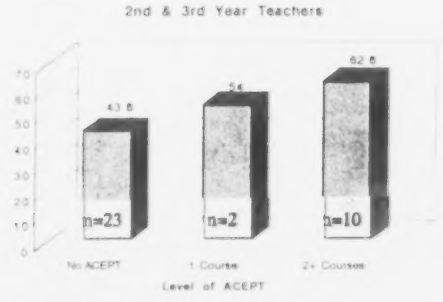

Figure 1 suggests that having one ACEPT course is no better than having none. There is no discernible difference of instruction between first year teachers who have not taken ACEPT courses and those with only one ACEPT course. Together, Figures 1 and 2 indicate that having 2 or more ACEPT courses makes a considerable difference. Although Figure 2 depicts a positive relationship between RTOP score and the level of ACEPT, the smallness (n=2) of the one-course group is a definite limitation.

Content and Grade Level

For the analyses to follow, "ACEPT teachers" shall be defined as those who have taken one or more ACEPT courses. With this convention in place, whether examining first year teachers or the more experienced second and third year teachers, a significant difference in the level of reformed instruction was discovered when comparing the ACEPT experimental group to the control group. A close analysis of subgroups based on content and grade level revealed interesting findings. Among first year teachers, RTOP scores varied significantly except for science teachers and teachers of grades 9-12.

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Among second and third year teachers, a statistically significant difference endured when examining subgroups of science and math (Tables 2 and 3).

Table 2

***First Year Teachers**. Comparison of ACEPT and non-ACEPT teachers.*

	Overall	Science	Math	Grades 5-8	Grades 9-12
ACEPT RTOP Mean	48.1 (n=41)	41.9 (n=23)	56.1 (n=18)	58.1 (n=16)	41.8 (n=25)
Non-ACEPT RTOP Mean	39.7 (n=10)	43.2 (n=6)	34.5 (n=4)	38.0 (n=5)	41.4 (n=5)
t	2.04	-0.213	5.462	3.235	0.072
p (2-tail)	=.05	.834	<.05	<.05	.943

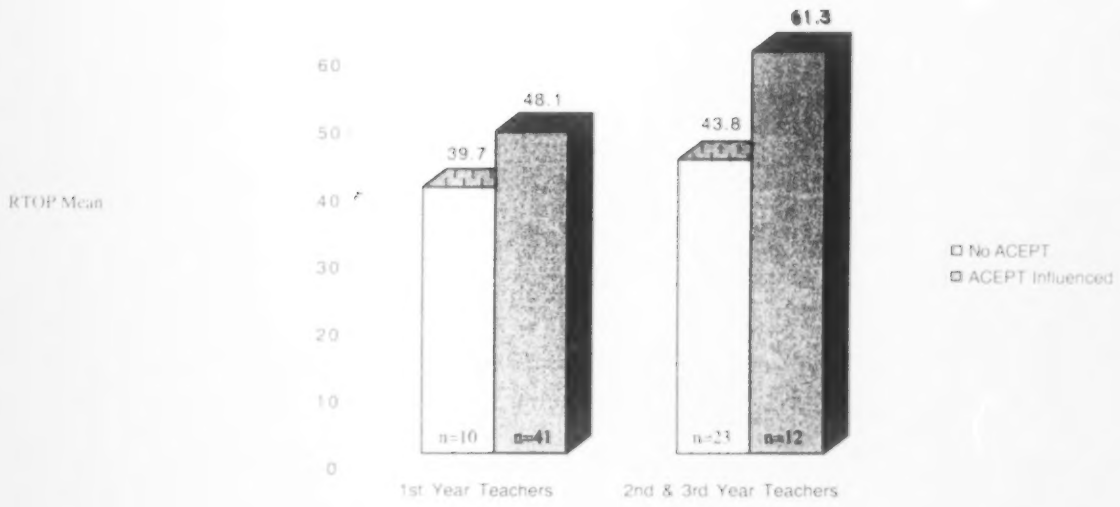
Table3

***Second and Third Year Teachers**. Comparison of ACEPT and non-ACEPT teachers.*

	Overall	Science	Math	Grades 5-8	Grades 9-12
ACEPT RTOP Mean	61.3 (n=12)	56.1 (n=7)	68.6 (n=5)	60.8 (n=5)	61.7 (n=7)
Non-ACEPT RTOP Mean	43.8 (n=23)	33.6 (n=5)	46.6 (n=18)	41.1 (n=14)	48.0 (n=9)
t	3.408	3.222	5.107	2.294	1.952
p (2-tail)	<.05	<.05	<.05	.063	.073

Figure 3 graphically demonstrates that years of experience and ACEPT strongly effect RTOP scores.

Figure 3



TEAMS

The TEAMS program (see accompanying paper in this paper set, Piburn & Baker) has graduated four cohorts of students, the first in 1997. Graduates of the first three cohorts were observed and their instruction gauged with the RTOP instrument, as were other teachers. The selection of the control group for comparison to TEAMS warrants a brief discussion. To compare TEAMS teachers to all teachers who had not graduated from this post-baccalaureate program would propose that the control group include teachers who had taken other ACEPT courses. Prudence and judgement dictated that

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TEAMS be compared to a combination of teachers who had never taken ACEPT courses and teachers who had only taken one ACEPT course.

Although the sample of first-year TEAMS teachers outperformed the control group, a statistical difference between the two groups was not discovered. Second- and third-year TEAMS teachers are considered to be teaching in a significantly more reformed manner (Table 4).

Table 4. Comparison of TEAMS and non-TEAMS teachers

	First year teachers		2nd & 3rd year teachers
TEAMS RTOP Mean	47.0 (n=17)		60.2 (n=6)
Non-TEAMS RTOP Mean	39.9 (n=25)		44.6 (n=25)
t	1.496		2.314
p (2-tail)	.143		< .05

Discussion

Broadly, ACEPT is seen to be accomplishing the goals laid out in its initial proposal. Viewed collectively, RTOP observations demonstrate that ACEPT teachers teach in a more reformed manner than the control group teachers. ACEPT has been able to essentially pop their heads into the classrooms of beginning teachers and check up on

teaching practices. Gauging the practices of graduates provides insightful information and leads to stirring questions. Such a follow-up is a rare connection between preservice and inservice institutions. Stratifying the data in an alternate form or focusing on subsets did not put ACEPT-prepared teachers in a poor light; rather, such sifting led to a number of interesting patterns suggestive of further hypotheses.

In order to sharpen the analysis of the data, ACEPT teachers were compared to control group teachers with the same level of experience. From this emerges the question "what is the relationship between years of experience and reformed instruction?" When comparing years of experience, both ACEPT and non-ACEPT teachers post striking RTOP gains. A review of field notes and informal conversations with ACEPT evaluators indicate that first year teachers struggle far more with classroom management. Common sense also leads one to conjecture that a completely novice teacher will grapple to institute any cohesive pedagogy. This is consistent with the findings of Chang (1998) who indicated that beginning science teachers tend to transmit content knowledge to students and seldomly are observed using the most appropriate instructional practices. It is posited that learning to teach is itself a constructivist activity. As teachers gain comfort with factors such as classroom management and content, they begin to construct practical alignment between the theory of university experience and the learning environment of the classroom.

Indeed, the RTOP instrument addresses elements typically associated with both inexperienced and experienced teachers such as lesson design and effective communication. Close scrutiny of RTOP scores reveals that in all but one subsection (Propositional Knowledge) ACEPT and non-ACEPT teachers post gains as teaching experience increases. Moving from the first year of teaching to the second year, gains are *statistically significant* for ACEPT teachers in all subsections of the RTOP except Propositional Knowledge. A similar examination of non-ACEPT teachers reveals no significant gains occurring within any subsection (Table 5).

Table 5. Comparison of RTOP subsection mean scores.

RTOP Subsection	ACEPT Teachers			Non ACEPT Teachers		
	1st Year (n=41)	2nd & 3rd Year (n=12)	p (2-tail)	1st Year (n=10)	2nd & 3rd Year (n=23)	p (2-tail)
Lesson Design & Implementation	8.56	11.25	.025	6.10	7.35	.199
Propositional Knowledge	11.85	13.58	.137	11.40	10.78	.643
Procedural Knowledge	7.98	10.50	.042	5.30	6.52	.231
Communicative Interactions	9.32	12.08	.022	7.20	9.13	.052
Student/Teacher Relationships	10.44	13.92	.005	9.70	10.00	.786

That teachers acquire skills allowing for more effective instruction as they gain experience comes as no surprise. However, what does emerge as a trend is that ACEPT teachers are outpacing the control group in every subsection.

The general hypothesis that enrolling in ACEPT courses leads to greater reformed instruction may be overly simplistic. In addition to showing that one ACEPT course has little or no impact (Figures 1 and 2), these data also imply the possible existence of a critical threshold point. At the threshold it can be hypothesized that the teacher is likely to adopt a more innovative teaching style; below the threshold, the ACEPT teacher is not dissimilar to the more traditional non-ACEPT teacher. This more refined "threshold hypothesis" is consistent with data collected in other ACEPT settings and supported by the NCRTL survey of over 700 teachers (1992). For example, in the setting of Summer Workshops, the notion "one course is not enough" becomes "one workshop is not enough." A question related to this idea of exposure is one of self-selection. After encountering their first ACEPT course, might students who relish the inquiry method seek out further ACEPT courses? At Arizona State University, students are notified of the courses endorsed by ACEPT. An attentive student could consciously choose to avoid or to select further ACEPT courses.

Supporting the concept that ACEPT teachers outpace the control group are data related to the specific disciplines of science and math (Tables 2 and 3). For science, no

statistical difference exists between the ACEPT and non-ACEPT teachers during the first year of teaching. However, a significant ACEPT effect emerges during the second year of teaching for both math and science teachers. Considering the composite data previously discussed this is not an unanticipated finding. What is an unexpected observation is that math teachers often achieve considerably higher RTOP scores than science teachers (the exception being first year non-ACEPT). Collectively, beginning math teachers have an average RTOP score of 51.77 while science teachers only average 43.50. This is nearly a 20% difference. If an observer were able to view a typical science classroom through a window, superficially there is a good chance it would appear more reformed than an archetypal math classroom. One might observe science students working as groups and handling equipment as the teacher walked from one group to another. However, the RTOP instrument allows for the fine-tuning that detects actual dynamics and critical thinking occurring during a lesson. What ACEPT evaluators surmise is that science classes have remained more prescriptive than their math counterparts. Although science students are often assigned to work as groups in class, they are not necessarily pressed toward true inquiry. Such classroom activity may be denoted by what Moscovici (1999) termed "activitymania," wherein there exist a series of disconnected hands-on experiences. The metaphor of "cookbook science" still applies in classrooms even where the teacher may sense he or she has adopted reforms. Meanwhile, math teachers are adopting several techniques to make their classes more engaging. No longer the exclusive

property of science classes, math students are often found working collaboratively, discussing and critiquing problem solving techniques. Beginning math teachers also seem to be more productive at asking higher order questions and putting onus upon students to discover patterns and explain their thinking. Perhaps because the subject of math is inherently not as interesting for most students, math teachers have embraced reform methods with greater fervor.

Table 6. Comparison of Math and Science Teachers.

RTOP Subsection	Math (n=45)	Science (n=41)	p
Lesson Design & Implementation	9.09	7.49	.068
Propositional Knowledge	12.38	11.07	.067
Procedural Knowledge	8.38	6.80	.063
Communicative Interactions	10.40	8.32	.009
Student/Teacher Relationships	11.53	9.83	.035
Total RTOP score	51.78	43.51	.022

Table 6 indicates that math teachers are achieving greater reform gains in a well-rounded manner. That is to say, for two of five subsections of the RTOP, math teachers score significantly higher than science teachers; for the remaining three subsections the difference of scores remains impressive. Yet, the researchers are open to the criticism that the many math teachers chosen for this study may not be representative of the general population. More than half of the math teachers observed in this study were in a district that has a well developed reformed math curriculum and provides ongoing support in the

way of targeted professional development and mentoring to support the reform math curriculum. This consideration is aligned with the findings of LaBerge and Sons who discovered, in terms of the factors felt to contribute to successful implementation of the NCTM standards, more than 75% of the teachers in grades 5-12 cited their principals' support and support of other faculty (1999).

ACEPT evaluators have collected RTOP data in a variety of settings. These environments have included large college lectures, small recitation classes, and laboratories. Early evidence indicates that there may be inherent factors associated with these different environments that can be both conducive and obstructive to reform methods. Among the beginning teachers, second and third year ACEPT teachers are the highest performing with an approximate 60 point RTOP score. Yet ACEPT has not yet positioned itself to state at what RTOP level instruction may be defined as reformed. Indeed the unique settings of middle school and high school present challenges for the reform-minded teacher. College instructors who have embraced reformed pedagogy have received RTOP ratings consistently over 80 points; such scores have yet to be observed in the K-12 classroom. It is possible to premise that the upward trend observed from the first to the third year of experience will continue and ACEPT evaluators need merely visit more experienced classroom teachers if they wish to observe highly reformed classrooms. However, such a simple extrapolation may be overly simplistic; *years of experience* is an

omnibus variable harboring many complexities. Other factors such as beliefs, available resources, school expectations, and reasoning skills should be considered in further investigations. Offered as modest insight into the particular challenges faced by beginning classroom teachers, vignettes are included in this paper (see Appendix). These vignettes may help the reader better understand how obstacles to student-centered teaching may at times become boundaries.

Conclusions

Scrutiny of the beginning teacher data generates discussion that poses further questions for investigation. Yet, while examining subsets of data leads to contemplation and even controversy, one strong conclusion may be drawn from the statistics. ACEPT courses do meaningfully affect students who later become classroom teachers. Noteworthy in this effect is the finding that students who have taken two or more ACEPT courses go on to teach in a significantly more reformed manner than people who have had either one ACEPT course or no ACEPT experience. In this sense, completing two ACEPT courses may be taken as a threshold criterion for being "ACEPT-prepared". In turn, students reaching this criterion may be said to have taken an ACEPT "program" (especially true in the case of TEAMS). Teachers who have graduated from an ACEPT program are able to transfer reformed methodology to K-12 classrooms. The adage mentioned at the beginning of this report holds true: teachers do indeed teach as they

were taught. ACEPT teachers are delivering a much higher level of inquiry based instruction.

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Appendix

Points of Interest on the Graph

While aggregated data can provide understanding of trends, statistical significance, and even predictive ability, close examination of particular cases can yield greater insight into challenges faced by beginning teachers. Of course, how each beginning teacher confronts their particular challenges will be influenced by factors that include beliefs about instruction, self-efficacy, school support, and preservice preparation. Following a tenet of inquiry, the following vignettes are not presented as conclusive evidence to wholly explain the experiences of beginning teachers. Rather, these sketches represent a different settings and mindsets that were not singularly influenced by any one variable. It is for the reader to construct his or her own significance from these situations.

JD: Searching for support. JD is graduate of the third cohort of ACEPT's TEAMS program, a fast paced post-baccalaureate program aimed at preparing individuals to become technology-based science and mathematics teachers for grades 5 through 12 with secondary certification and middle school endorsement. During his preservice preparation, JD was enthralled with the program. In fact, following his graduation date, JD continued that summer with the TEAMS program as a graduate student to assist with the orientation of the incoming TEAMS cohort. JD was considered by his professors to

be a bright intelligent young man who would be well liked by his students. JD chose a teaching position that outwardly seemed challenging but rewarding. JD soon learned that the position he selected had several hidden demands that would grate at his wherewithal.

Excited to teach an integrated science and math curriculum and wanting to make a difference in the lives of economically deprived children, JD took a position in an inner city school that had recently instituted a new science and math integrated curriculum. JD taught a combined eighth grade science and math course that was blocked into 100-minute periods. At the same time, Paul (pseudonym), another graduate from the same TEAMS cohort took a similar position at this school. What JD and Paul soon discovered was that though their school had instituted a new concept of integrating science and math curricula with an earnest vision of student benefits, the school had not adopted any particular program for implementation. It was up to the individual teachers to form their own agenda, create lesson plans, and develop hands-on materials. All of this was in addition to managing a student body that did not largely share JD and Paul's beliefs of how education was the key to success, nor did the students share the experience of their teachers' middle-class backgrounds. Yet, JD was determined to make his class a successful learning environment. JD turned to the experienced math and science teachers at his school for assistance. However, while the reformed curriculum was supposedly required of all teachers, most of these teachers still taught the two disciplines as separate entities. Largely, the veteran teachers continued to provide the same science and math

lessons from years prior, emphasizing their area of expertise. Regarding day to day activities, JD would have to develop or find his own materials if he wished to truly implement the new curriculum. However, JD's attention was soon diverted from the dilemma of content to the problem of classroom management. JD found several of his students to be disrespectful and even unruly. Considering the often uncooperative student attitudes, attempting to organize hands-on materials soon seemed daunting to JD.

When JD was visited late in the Fall semester of his first year of teaching by ACEPT, he was clearly able to articulate his challenges, but did express that he was still enjoying teaching. The experienced teachers had provided JD with helpful suggestions on how best to maintain order and JD had gained, if not respect, at least quiet cooperation from of his students. JD said that he and Paul had jointly decided to put aside the integrated curriculum and concentrate on classroom management. They were teaching science this first semester and would teach math during the spring semester. When JD instructed his class, he did indeed implement many of the elements of inquiry learning. Yet, there was a very stilted feeling to his classroom. Though students were performing an experiment and were to determine the effects of altering variables, JD had setup the experiment in a very structured manner. Students did not develop any of their own hypotheses and their discussion was perfunctory, related only to completing the task at hand. JD was aware of the tight control, but this lesson was a type of compromise

between the sort of open ended inquiry he wished to implement and the type of discipline he felt his students required.

During that first school year, JD and Paul often carpooled - sharing classroom stories, talking about lesson plans, and commiserating. Compared to JD, Paul was handling his situation less well. Paul had frequent student disciplinary problems that were not abating. Additionally, Paul was internalizing the problems and continued to feeling aggravated even when he was away from school. Before the school year ended, Paul had resigned his position, leaving JD to make the drive alone.

JD remarked that he and Paul, along with two other beginning teachers (all from the TEAMS program), often socialized that first year of teaching. The four friends had all taken challenging middle school positions. Regarding the other two teachers, like Paul, both quit their positions before the school year ended. Both of these teachers took new positions the following year in conditions perceived to be better suited to their content expertise and teaching style. Paul never returned to teaching. It might be said that JD survived the peculiar challenge of not falling victim to his own support group. Apparently, the other three teachers were comforted in their decisions by knowing that they were not the only ones reneging their obligations.

Yet, JD knew that he would not be happy if he continued to teach in this school. He felt unsupported in his aspiration to build a reform classroom. The emphasis of the school's personnel seemed to be on heavy handed discipline and the students seemed

more comfortable with a traditional style of teaching. With the onset of JD's second year of teaching, he found himself taking a new position in a suburban district. He teaches eighth grade science in a middle school where he indicates he feels far better supported.

Laura: Nurtured toward reform. In JD's case it is simplistic to place blame on the nature of an inner city school. Parents may seem less supportive, even wary of teachers. Students might appear more accustomed to a traditional classroom. Administrative emphasis on "basics" possibly accents a lack of confidence in students to benefit from higher-order thinking instruction. In fact, research has shown students of lower socioeconomic status receive less instruction rooted in higher order thinking skills (Wenglinsky, 1999). Laura, a graduate of TEAMS' first cohort of students is a math teacher who has met the challenges of implementing reforms in an inner city school. Interestingly, Laura's school is no more than two miles from the school JD taught at during his first year of teaching. The schools are in the same district with similar ethnic and economic status of student populations. Also similar to JD's experience, was that Laura took a position at her school at the same time as did a peer from TEAMS, Gwen. Laura was to teach eighth grade math and Gwen was assigned to fifth and sixth grade science. A striking contrast to JD's first school is the organization of Laura's school. While JD taught at a 7th and 8th grade junior high school, Laura teaches in a K-8 school. For grades K-4, Laura's school draws only students from the immediate neighborhood. For grades 5-8, the school is a magnet school for science and math, thus it attempts to

attract enthusiastic middle school students from within the district who have demonstrated an interest in science and/or math.

Laura reflects that her first year of teaching was particularly arduous. Long hours, developing lesson plans, and dealing with discipline were among her challenges. It can be said these challenges are not distinct from those faced by most beginning teachers, and even most veteran teachers. Like many beginning teachers, Laura too confronted the task of aligning the type of instruction she valued and had envisioned in her classroom with what seemed to work for her students. But Laura's school staff proved to be extremely supportive and reassuring. Her school had developed a tradition of student participation and was persistent to involve parents. Fellow teachers provided Laura with lesson suggestions and earnestly valued her ideas. Laura discovered that, although she would have to instill structured discipline in her classroom, the most reliable source of a well managed class stemmed from engaging lessons. Her peer, Gwen, also proved a valuable source of solace. Although she and Gwen taught different grade levels and content, Laura found it beneficial to discuss with Gwen the theoretical basis and the underpinnings of reform learned during their preservice experience. Through these discussions, Laura was able to place in perspective how the sometimes-seeming abstract concepts of reform education could effectively be put in place in her classroom. Laura has also maintained communication with the TEAMS program during the past few years through occasional use of the TEAMS listserve, telling her peers about her experiences and directing her

former classmates to interesting education web sites. Additionally, Laura was selected by TEAMS, during her first year of teaching, to visit with the National Science Foundation in Washington DC. By her fourth year of teaching Laura accepted to mentor a TEAMS student teacher.

When Laura's classroom was last observed by ACEPT she and her students represented a wonderful supportive community. Despite that much of the lesson time was devoted to reviewing math homework, a typically mundane chore, Laura's class demonstrated remarkable collaborative efforts. Students took it upon themselves to explain to other students their solutions and were accepting of varying methods. Laura's asked questions that were rarely directed toward a single student presenting a problem, rather she impelled pupils to consider the merits of another's work - to articulate appreciation and provide suggestions when needed. In a sense, Laura was promoting a fellowship of support mirrored in her own professional experiences.